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Debt Risk Analysis of Automotive Enterprises

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Abstract: In order to maintain their financial stability, businesses must recognize and manage the financial risks that are necessarily involved in their operations and output. Businesses may better comprehend their financial status and undertake efficient risk early warning by examining financial indicators. Academic research on the detection and mitigation of financial risks is extensive, and in an effort to increase the accuracy of assessments, an increasing number of academics are using multi-indicator systems for thorough analysis. Furthermore, non-statistical techniques including hierarchical analysis, B-S option pricing models, and artificial neural networks have shown extremely effective at handling complicated data and non-linear connections. As the economy transitions from high to medium-high growth, traditional and new energy vehicles in the automobile sector confront significant possibilities and problems. Traditional automakers aggressively converting to new energy cars include SAIC Motor, BAIC Group, and GAC Group. Companies that produce new energy vehicles, such XPeng, BYD, Tesla, Li Auto, and NIO, are becoming more competitive by developing new technologies and tapping into new markets. To enhance market competitiveness and sustainability, businesses must address issues like excessive inventory and price volatility that have been brought about by the new energy vehicle market's explosive expansion through efficient financial risk management. The short- and long-term debt repayment capacities of traditional and new energy vehicle (NEV) enterprises are the main subjects of this study's analysis of their financial statements. According to the findings, traditional automakers have more stable financial circumstances whereas NEV enterprises exhibit stronger short-term solvency and lower long-term financial risk in specific years with superior liquidity and lower debt ratios. The study attempts to offer resources for the automobile industry's deleveraging, sustainable development, and inventory reduction.

Keywords: new energy vehicles (NEVs); financial risk; long-term solvency; short-term solvency; inventory reduction; deleveraging

1. Introduction

Every productive activity that an organization engages in has some risk, but financial risks are especially important. It is inevitable that the business will have financial risk as long as it has liabilities. We can efficiently monitor the financial risk of the business and quickly assess its financial condition via early warning and detection of financial danger. Financial indicators enable the research to more accurately depict the enterprise's financial risk. Numerous academics both domestically and internationally have studied company financial risk detection and prevention in great detail from various angles. A growing number of academics are turning to multiple indicator systems to assess financial risk more thoroughly, as single indicators have limits that make it difficult to fully capture the capital structure and operational circumstances of businesses. These multi-indicator

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systems increase the efficacy of risk management by providing a more thorough and accurate assessment of an organization's financial health. Numerous academics also do early warning studies and financial state analyses of businesses using non-statistical approaches. These approaches are inclusive and encompass a range of concepts and strategies. In their evaluation of the use of artificial neural networks in financial forecasting, for instance, ANN has several benefits when handling complicated data patterns and nonlinear correlations, as noted by Xian Liu and Hao-Long Liu [1]. The B-S option pricing model was employed to evaluate whether a firm is experiencing a financial crisis, as demonstrated by Jiang X [2]. A research on the assessment of business financial risk using fuzzy comprehensive evaluation techniques and hierarchical analysis was suggested by Wang Tao in 2024 [3]. An optical path transmission quality prediction method based on artificial neural network (ANN) loss function optimization was investigated, and the accuracy of the prediction model was improved by optimizing the loss function design, as discussed by Shi Yannan [4]. The GA-optimized ANN processing method obtains higher machining efficiency, though a certain degree of degradation occurs relative to the initial surface quality. Better machining performance can be achieved by adjusting the weighting coefficients, as noted by Feng Lei (2024) [5]. SVM and ANN were used to study the risk and early warning of listed enterprises, and the development of risk early warning management throughout history was reviewed, along with a systematic analysis of current domestic and international mainstream enterprise risk early warning models, as highlighted by Xinxin Xu [6]. The use of statistical techniques in early warning studies has increased among academics. In a study by Wang Qianyi (2019), a small and medium-sized international trade firm was chosen, and the risk of its financial position was assessed using the Z-score and F-score models after analyzing its development history, organizational structure, and industry status quo [7]. To assess the financial risk, a company's most recent financial records were examined using the Z- and F-score models Cao Jiahao (2023). According to the data, the Z-score model revealed considerable financial risk for the firm, while the F-score model indicated low financial risk in the initial years and a greater probability of bankruptcy in the last year [8]. The financial risk was evaluated and categorized using the effectiveness coefficient approach and the F-score model Zhang Jialao (2023). The study's findings demonstrated that the business is consistently exposed to financial risk, particularly in areas such as funding, investments, operations, and growth. Zhang recommended implementing matching control countermeasures, including enhancing market discovery and technological innovation, strengthening the analysis of investment benefits, optimizing the capital structure, upgrading the internal control system, and raising employee awareness of risk prevention [9]. The company's financial risks were assessed and compared using the financial indicator technique and the F-score model Gu Zhihao (2023). Additionally, the study determined and examined the reasons behind these financial risks [10]. A demand forecasting approach was developed using time aggregation as a carrier, based on the Z-score and F-score models, to screen and evaluate financial indicators Liu Wei Zhu De (2022). The study found that this method is more accurate and significant for research compared to the Z-score model [11]. An analysis of Azalea Automobile's financial risk was conducted using the Z-score model, the entropy value approach, and the effectiveness coefficient method He Jiongmei. The study revealed issues with the company's capacity to service debt, operate profitably, and grow. To help new energy automotive firms prevent and control financial risks, the study also suggested relevant coping mechanisms and the establishment of a financial risk early warning system [12]. The Z-score and F-score models were used to conclude that the financial risk is relatively low Wang Di (2018). To enhance the financial risk detection, analysis, and response capacity of businesses, corresponding solution strategies were proposed. These methods serve as a valuable benchmark for the financial risk management of companies that manufacture similar automobiles [13,14]. Our researchers have strengthened the model by incorporating crucial elements like cash flow to compensate for the original Z-score model's drawbacks. The F-score model was proposed by Zhang Jialao in 2023. Numerous empirical investigations have been carried out by other researchers utilizing statistical analytic techniques and univariate and multivariate discriminant models put forth by researchers domestically and internationally, respectively, to forecast and assess the financial risks of Chinese firms. The majority of academics both domestically and internationally build analytical models based on financial indicators, regardless of whether statistical techniques are applied for financial risk analysis. Effective solvency control is the cornerstone of corporate financial risk management. In order to undertake case studies, examine

the actual debt structures of eight domestic automakers, evaluate the impact of their financial leverage, and impartially estimate their debt risk, this article primarily applies the pertinent solvency indicators to the heavily indebted car sector. This will serve as a model for the "de-stocking," "de-leveraging," and development that is both sustainable and healthful in the automotive sector.

2. Current Situation of China's Automotive Industry

The automobile sector is experiencing both unparalleled possibilities and problems as China's economy transitions from double-digit high growth to single-digit medium-high growth. Environmental protection and the energy transition are putting pressure on the conventional automobile industry, which means it needs to constantly develop and adapt. With its advantages over existing cars and their minimal carbon footprint, new energy vehicles (NEVs) have emerged as a major area of future development. In this setting, new market positions and development strategies are sought after by NEV firms like NIO, BYD, Tesla, Li Auto, and XPeng, as well as traditional automotive heavyweights like SAIC Motor, BAIC Group, and GAC Group.

The market for new energy vehicles (NEVs) has grown quickly in recent years, drawing interest from both investors and customers. Nevertheless, the business also has to deal with issues including excessive inventories and volatile prices. The automobile industry is facing significant changes and transformation, much like the real estate sector did following a steep fall in sales and mounting inventory, which led to strategic reorganization. While newer NEV businesses like NIO, BYD, Tesla, Li Auto, and XPeng are steadily gaining market share and a competitive advantage through technology advancements and product quality improvements, established automakers like BAIC Group and GAC Group are aggressively entering the NEV industry.

The automobile sector needs to handle the crucial problem of inventory reduction in this process. In addition to requiring a large amount of corporate capital and putting financial strain on businesses, high inventory levels also run the danger of starting pricing wars, which can upset the equilibrium of the market and harm a brand's reputation. Major automobile businesses have used a number of inventory reduction initiatives in order to address this difficulty. For instance, they are actively entering foreign markets to find new sales channels, stepping up promotional activities by providing discounts to draw customers, and modifying production schedules and output reductions to manage stock levels. During this process, financial risk management has become very crucial. In order to improve their resilience and competitiveness in the market, companies need to make sure they can accurately and promptly identify risks and take appropriate action. In addition to assisting businesses in navigating market shifts, researching the development status and trends of the conventional and new energy vehicle sectors and investigating how efficient financial risk management techniques can increase corporate competitiveness also strongly support the industry's overall sustainable growth.

3. Overview of Traditional and New Energy Vehicles

Known as SAIC Motor, SAIC Motor Corporation Limited is a multi-sector operating company that works in passenger automobiles, commercial vehicles, financial services, foreign operations, automotive services and trade, and component manufacture. Several well-known brands, including SAIC Volkswagen, SAIC GM, SAIC GM Wuling, and Roewe, are owned by SAIC Motor. SAIC Motor has positioned itself strategically in the new energy vehicle and intelligent connected vehicle sectors in response to national policies in recent years. The business has made significant investments in technological R&D and has introduced a number of innovative energy vehicle products, including the MG EZS and the Roewe Marvel R. SAIC Motor's revenue in 2023 was RMB 744.705 billion, an increase of 0.1% from the previous year.

With a wide range of operations, the BAIC Group offers financial services, automotive services and trade, passenger automobiles, commercial vehicles, and component production. BAIC Motor, Beijing Hyundai, Beijing Benz, and BAIC New Energy are just a few of the brands that the firm controls. Being one of the major participants in China's NEV market, BAIC Group made early investments in the new energy vehicle industry. 2023 saw a 3.9% yearly growth in revenue for BAIC Group, totaling RMB 197.949 billion. RMB 0.38 represented the basic earnings per share. At the end of 2023, total assets were RMB 168.72 billion, a 3% decline from the previous year, while total equity was RMB 79.383 billion, a 1% gain. Beijing Automotive sold

1.042 million cars in 2023, a 7.3% increase over the previous year.

The business of GAC Group encompasses a wide range of industries, including finance, international business, automotive services and trading, parts production, passenger automobiles, and commercial vehicles. Several well-known brands, including GAC Honda, GAC Toyota, GAC Transqi, and GAC New Energy, are owned by the GAC Group. Notable is also GAC's advancement in the realm of new energy vehicles. The BAIC Group's overall revenue in 2023 increased by 3.93% to RMB129.706 billion. Sales volume of cars: 2.550 million pieces. At the end of 2023, total assets of 218.394 billion yuan represented a 15.05% rise over the previous year, while basic earnings per share of 0.42 yuan represented a 2% annual increase in total owners.

Driven by innovation, NIO Inc. is a leading Chinese and international electric vehicle manufacturer, standing out in both markets for its high-end goods, cutting-edge technology, and first-rate services. Under the ticker code NIO, it is traded on the New York Stock Exchange (NYSE). Thanks to its superior goods and services, NIO has established itself as a leader in the market for high-end electric vehicles. With a 12.9% yearly growth, the company's total revenue in 2023 was RMB 55.6179 billion. Revenue from car sales was RMB 49.2573 billion, an 8.2% increase over the previous year. There were RMB 12.44 in basic profits per share. Total assets reached RMB 147.383 billion at the end of 2023, up 21.94% from the previous year; total equity reached RMB 25.546 billion, a 7% annual gain.

Leading the way in the production of plug-in hybrid, internal combustion engine, and electric cars worldwide is BYD. Among the noteworthy models are the BYD Tang, Qin, Han, and Song. As part of its comprehensive offering of green energy solutions, the firm also produces electric buses, solar panels, and energy storage systems. With production facilities and sales networks located all over the world, BYD has continuously had some of the highest worldwide sales of new energy vehicles. The firm has a strong financial position, consistent sales and profit growth, and a market value that is among the highest in the worldwide new energy vehicle industry. It is listed on the Shenzhen and Hong Kong stock markets. BYD's total income in 2023 was RMB 602.315 billion, a noteworthy 42% yearly growth. Basic earnings per share increased significantly from RMB 5.71 to RMB 10.32 in the prior year. At the end of 2023, BYD had total equity of RMB 113.715 billion, up 28.6% from the previous year, and total assets of RMB 679.547 billion, up 37.6%.

Based in Palo Alto, California, Tesla, Inc. is a renewable energy and electric car corporation. Worldwide, Tesla maintains production sites and sales networks in several nations and areas. The Fremont facility in California and the Gigafactory Shanghai are two of its primary manufacturing locations. Tesla has become a dominant force in the worldwide electric car industry as a result of its recent growth in vehicle sales and market share. With a market value among the greatest in the worldwide car sector, Tesla is one of the companies whose stocks is listed on the Nasdaq Stock Exchange under the ticker code TSLA. With a 16% year-over-year rise, Tesla's total revenue in 2023 was RMB 707.6 billion (about USD 96.8 billion). The income generated by the sales of vehicles was RMB 602.4 billion, or around USD 82.4 billion. The basic profits per share came to 21.69 RMB (or around 3.12 USD). By the end of 2023, Tesla's total assets had increased to RMB 2,071 billion (about USD 290 billion), an 18% year-over-year rise, and its total equity had reached RMB 207.1 billion (around USD 28.9 billion).

Li Auto's (formally Li Auto Inc.) range-extended electric vehicle (EREV) technology sets it apart. Electric cars with an internal combustion engine to extend range when the battery runs low are known as EREVs. Li Auto, which is aimed at the mid-to-high end market, places a strong emphasis on extended range, excellent performance, and an intelligent driving experience. The corporation wants to draw customers in with cutting-edge technologies and superior goods. Li Auto's overall revenue in 2023 increased by 173% year over year to RMB 123.851 billion. Revenue from car sales was RMB 49.2573 billion, an 8.2% increase over the previous year. There were RMB 5.95 in basic profits per share. In 2023, the company's total assets increased by 65.79% to RMB 143.467 billion, while its total equity increased by 34% to RMB 60.575 billion.

He Xiaopeng, who is presently the Chairman of Xpeng Motors, and other individuals formed the company with the goal of creating smart electric vehicles that lead the way in both technological innovation and user experience. The business has built a robust network of contacts in the Chinese and international markets. Targeting the mid-to high-end electric car market, Xpeng Motors places a strong emphasis on competitive price,

excellent performance, and intelligent features. The organization wants to draw customers in with its cutting-edge technology and inventiveness. With the ticker code "XPEV," Xpeng Motors went public on the New York Stock Exchange (NYSE) in 2020, joining the global electric car market. Xpeng Motors saw a 14% rise in revenue year over year in 2023, totaling RMB 30.676 billion. The income from car sales was RMB 28.01 billion, up 13% from the previous year. Each share was worth RMB 5.96 in basic earnings. As of the end of 2023, the company's total assets amounted to RMB 84.162 billion, an 18% growth over the previous year, while its total equity was USD 3.6328 billion, a 2% decline.

4. Analysis of Debt Solvency Risks for Traditional and New Energy Vehicles—Based on Financial Statements

For ease of comparison, comparable companies in the same industry, including both traditional and new energy vehicle manufacturers, were selected as references. These include SAIC Motor, BAIC Group, GAC Group, NIO, BYD, Tesla, Li Auto, and XPeng.

4.1. Short-Term Solvency Analysis

The current ratio and the quick ratio are the metrics most frequently used to assess a company's short-term solvency. When a company's current ratio is empirically valued at about 2, it indicates that it has the potential to turn current assets into cash before short-term debt expires. When inventory with poor liquidity is excluded, the quick ratio roughly represents the ratio of current obligations to current assets. An empirical value of 1 is considered appropriate. The current and quick ratios of traditional and new energy vehicle companies in recent years are shown in Table 1.

Table 1. Short-term Solvency of Traditional and New Energy Vehicle Companies.

	Traditional Vehicles						**New Energy Vehicles**									
	SAIC Motor		**BAIC Group**		**GAC Group**		**NIO**		**BYD**		**Tesla**		**Li Auto**		**XPeng**	
Year-End	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**	**Current Ratio**	**Quick Ratio**
2023	1.13	0.31	1.06	0.24	1.31	0.42	1.22	0.18	0.66	0.18	1.73	0.24	1.57	0.14	1.51	0.21
2022	1.07	0.30	1.04	0.27	1.62	0.51	1.29	0.19	0.72	0.06	1.53	0.22	2.45	0.06	1.81	0.29
2021	1.13	0.42	0.94	0.31	1.25	0.32	2.18	0.27	1.26	0.07	0.43	0.06	4.33	0.05	2.71	0.22
2020	1.11	0.38	0.90	0.28	1.34	0.29	3.31	0.22	1.05	0.32	0.51	0.06	7.28	0.73	5.06	0.28
2019	0.28	0.38	0.94	0.27	1.37	0.22	0.52	0.28	0.99	0.56	1.13	0.15	1.08	0.26	1.50	0.40
2018	0.30	0.33	1.01	0.33	1.65	0.17	1.42	0.48	0.99	0.66	0.83	0.11	-	-	-	-

Based on the data from Table 1, there are significant differences in the short-term debt repayment capacities of various automotive companies. Tesla, Li Auto, and XPeng have higher current ratios, indicating stronger short-term debt repayment abilities, while BYD and BAIC Group have lower quick ratios, reflecting weaker short-term debt repayment capacities. This is illustrated in Figures 1 and 2.

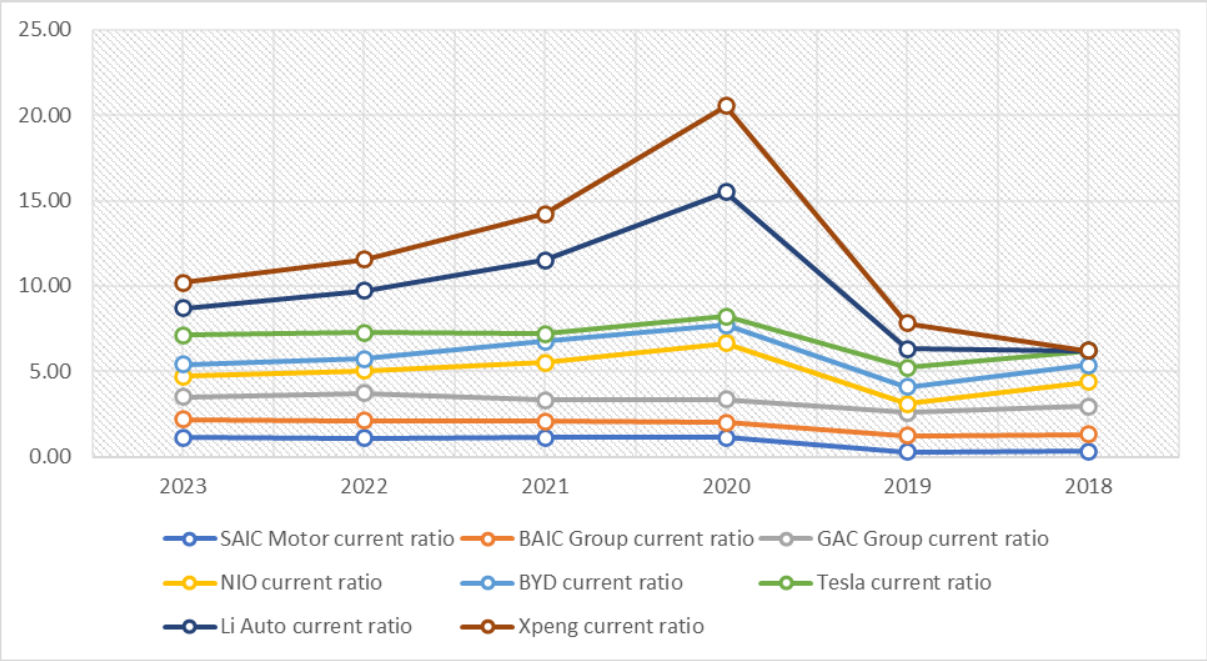

Figure 1. Changes in Current Ratios of Traditional and New Energy Vehicles.

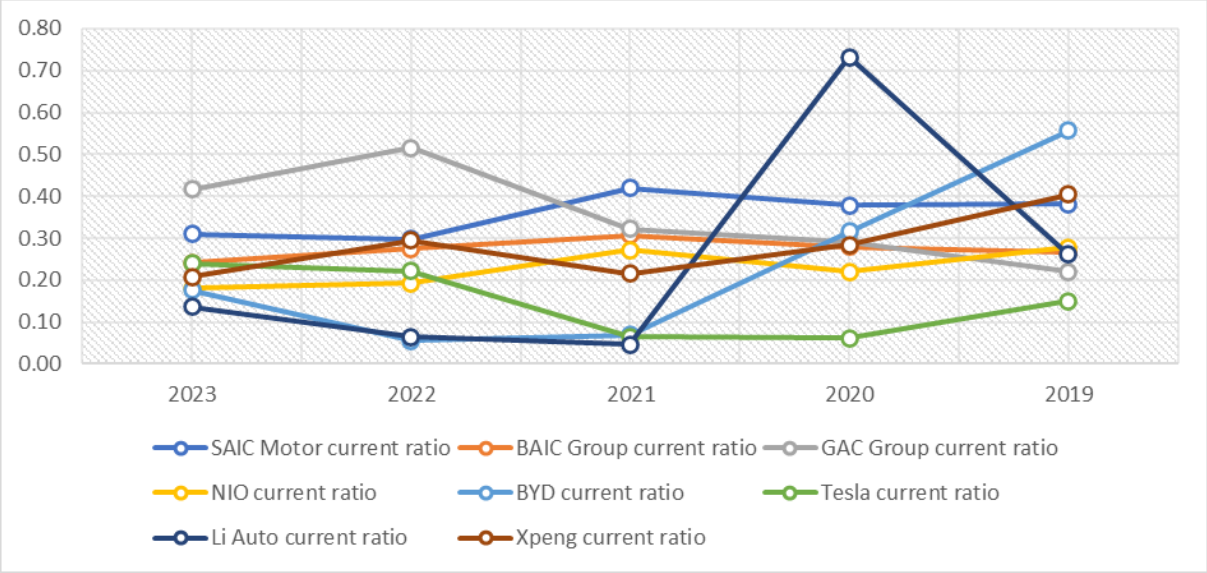

Figure 2. Changes in Quick Ratios of Traditional and New Energy Vehicles.

Table 1 and Figures 1 and 2 show that SAIC Motor Corporation's current ratio dropped to 0.28 in 2019, which is the lowest point ever, in 2019, suggesting a poorer capacity to repay short-term debt. The current ratio improved to 1.13 by 2023, indicating a better ability to repay short-term debt. The quick ratio grew to 0.42 in 2021 after being lower in 2018 and 2019, at 0.30 and 0.38, respectively, suggesting more liquidity. The BAIC Group's current ratio steadily improved as liquidity gradually improved, from a low of 0.90 in 2020 to 1.06 in 2023. Throughout the time, the quick ratio was comparatively constant, dropping from 0.33 in 2018 to 0.24 in 2023. The current ratio for GAC Group showed comparatively consistent liquidity, peaking at 1.65 in 2018 after reaching its lowest point of 1.25 in 2021. The quick ratio showed strong liquidity in several years, peaking at 0.51 in 2022 and falling to 0.17 in 2018. NIO's current ratio showed a notable short-term increase in liquidity, peaking at 3.31 in 2020 and falling to 0.52 in 2019. The fast ratio indicated decreased liquidity in various years; it peaked at 0.48 in 2018 and fell to 0.18 in 2023. BYD's current ratio varied throughout time, peaking at 1.26 between 2018 and 2021 and then falling to 0.66 in 2023. The quick ratio showed very low quick assets in 2020 and 2022, peaking at 0.66 in 2019 and falling to 0.06 in those same years. Tesla's current ratio showed a progressive improvement in liquidity, peaking at 1.73 in 2023 and down to 0.43 in 2021. With fewer fast assets

in those years, the quick ratio peaked in 2023 at 0.24 and fell to 0.06 between 2020 and 2021. Li Auto's current ratio peaked at 7.28 in 2020 and was zero in 2018, indicating a significant improvement in liquidity in the short term. The quick ratio was highest at 0.73 in 2020 and zero in 2018, showing a significant increase in quick assets. XPeng's current ratio was highest at 5.06 in 2020 and zero in 2018, indicating a notable increase in liquidity in the short term. The quick ratio peaked at 0.40 in 2019 and was zero in 2018, reflecting increased quick assets. It is clear from comparing these automakers' current and quick ratios that new energy vehicle companies—like NIO, Li Auto, and XPeng—showed particularly strong liquidity in several of these years. Traditional automakers, on the other hand, including SAIC, BAIC, and GAC, showed more steady liquidity with little swings, indicating a more cautious financial posture. Leading worldwide manufacturer of new energy vehicles, Tesla, likewise exhibits a year-over-year trend of increasing cash, demonstrating sound financial standing.

4.2. Long-Term solvency

Long-term solvency is primarily measured by two indicators: the debt-to-asset ratio and the equity ratio. The debt-to-asset ratio is a comprehensive metric used to evaluate a company's debt level and long-term solvency. A higher debt-to-asset ratio indicates a heavier debt burden and weaker solvency, while a lower ratio suggests a lighter debt burden and stronger solvency. The debt-to-asset ratios of traditional automotive companies and new energy vehicle companies in recent years are shown in Table 2.

Table 2. Debt-to-Asset Ratios of Traditional Automotive and New Energy Vehicle Companies.

Year-End	SAIC Motor	BAIC Group	GAC Group	NIO	BYD	Tesla	Li Auto	XPeng
2018	0.033	0.025	0.012	0.062	0.332	0.739	0	0
2019	0.031	0.009	0.013	0.491	0.388	0.388	0.025	0.183
2020	0.033	0.014	0.021	0.109	0.386	0.386	0.014	0.037
2021	0.037	0.021	0.018	0.028	0.064	0.064	0.097	0.026
2022	0.041	0.015	0.026	0.113	0.026	0.026	0.111	0.065
2023	0.057	0.024	0.041	0.111	0.018	0.403	0.012	0.067

As shown in Table 2, since 2018, the long-term solvency of various companies has fluctuated over this period. Some companies have shown a stable growth trend, while others have experienced greater financial pressure and volatility, as illustrated in Figure 3.

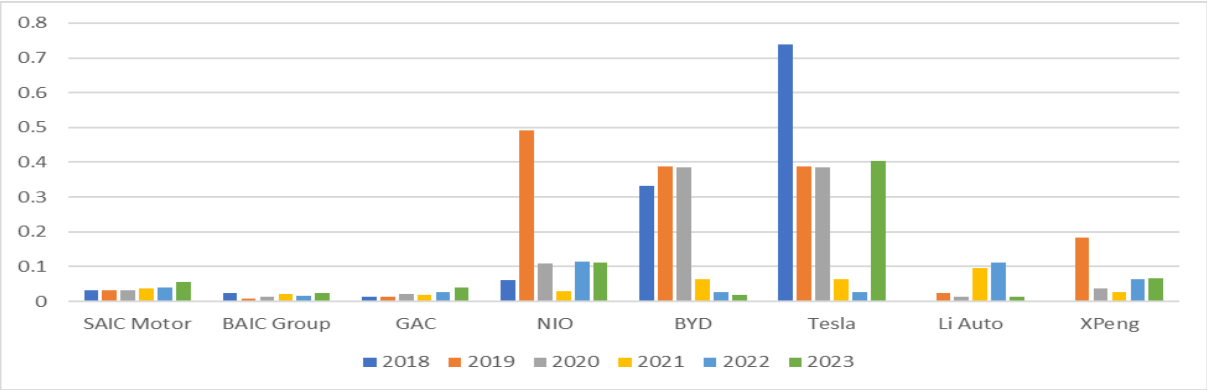

Figure 3. Debt-to-Asset Ratios of Traditional Automotive and New Energy Vehicle Companies.

Based on the statistics, we can see that SAIC Motor's long-term solvency has improved year over year, suggesting a stronger financial position. The solvency of the BAIC Group fluctuated throughout time, bottoming

out in 2019 before rising again, maybe as a result of financial strain in certain years. The long-term solvency of GAC Group has increased yearly, demonstrating notable advancements in strengthening financial stability. NIO's solvency increased in 2019 but then fluctuated, presumably as a result of the business's growth and investment operations. After peaking in 2018, BYD's long-term solvency has been steadily declining, suggesting possible financial hardship. Tesla's solvency fluctuated a lot, peaking in 2018, falling in the years that followed, and then rising in 2023. Data for XPeng and Li Auto began in 2019, with XPeng's solvency exhibiting a reasonably consistent growth pattern and Li Auto's solvency showing a considerable surge in 2021 and 2022 before falling.

4.3. Equity Ratio

The equity ratio reflects the degree of protection that shareholders' equity provides to creditors' equity. The higher the ratio, the weaker the company's long-term solvency, and vice versa. The equity ratios of traditional automotive and new energy vehicle companies in recent years are shown in Table 3.

Table 3. Equity Ratios of Traditional Automotive and New Energy Vehicle Companies.

Year-End	SAIC Motor	BAIC Group	GAC Group	NIO	BYD	Tesla	Li Auto	XPeng
2018	36%	36%	59%	36%	91%	75%	0%	0%
2019	35%	42%	60%	−43%	29%	19%	−60%	18%
2020	34%	38%	61%	50%	28%	43%	82%	4%
2021	36%	41%	60%	42%	20%	47%	66%	3%
2022	34%	46%	64%	25%	25%	54%	52%	6%
2023	34%	47%	57%	22%	22%	25%	42%	7%

As shown in Table 3 The comparatively high equity ratios of BYD and GAC Group suggest a higher dependence on loan financing. On the other hand, XPeng's equity ratio is lower, indicating a greater dependence on equity funding. The notable oscillations in the equity ratios of NIO and Li Auto underscore the fiscal difficulties and adaptations that these nascent automobile enterprises encounter as they grow and mature.

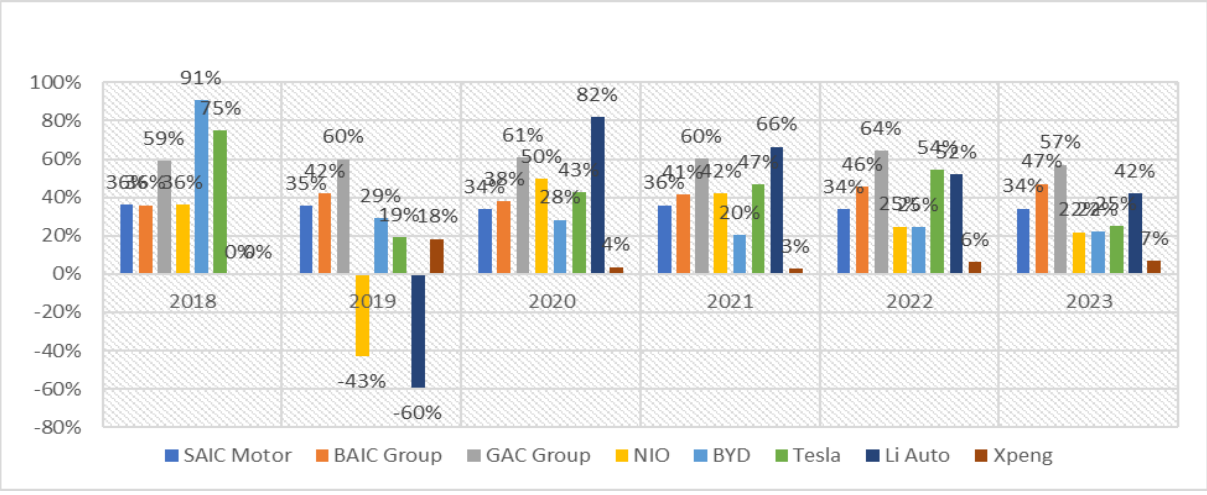

Figure 4. Equity Ratios of Traditional Automotive and New Energy Vehicle Companies.

As shown in Figure 4 The financial leverage reflects the extent to which a company uses debt to increase its capital. The range of 34% to 36% for SAIC Motor's equity ratio indicates that the firm has kept its degree of financial leverage largely constant. The business has demonstrated responsible use of financial leverage by keeping its debt and shareholders' equity in balance. The equity ratio of BAIC Group grew from 36% in 2018 to

47% in 2023, demonstrating that while the company has raised its financial leverage, the percentage of debt it possesses has also climbed. The variability of GAC Group's equity ratio, which ranged from 59% to 64%, indicated a greater dependence on debt funding. In 2023, NIO's equity ratio dropped from 91% in 2018 to 22%. The corporation may have suffered large losses or a spike in debt in 2019 based on the negative equity ratio. The company's financial leverage has dramatically dropped since then, indicating efforts to lower debt and enhance capital structure. In 2018, the equity ratio of Tesla was 75%; it fell to 19% in 2019, increased to 54% in 2022, and then decreased to 25% in 2023. Over time, Tesla's financial leverage has fluctuated, indicating that the business has implemented varied debt management techniques in response to shifting market and financial situations. Li Auto's 2019 equity ratio was negative (-60%), showing that the business could have had large losses or a spike in debt during that year. The equity ratio then steadily increased to 42% by 2023. In 2019, XPeng's equity ratio was comparatively low at 18%, and it continued to hover between 4% and 7% in the subsequent years. The low equity ratio suggests that XPeng used financial leverage more sparingly and depended less on debt during this time.

5. Analysis of Debt Solvency Risks for Traditional and New Energy Vehicles—Based on Perpetual Bond Financing

5.1. Market Ratings of Traditional and New Energy Vehicles

SAIC Motor has used a number of financing strategies, such as capital market financing and bank loans, to obtain money. These strategies are based on the financial statements and market performance of significant automakers. Regarding bank loans, SAIC Motor has forged alliances with financial institutions to secure the long- and short-term financing required to fulfill its investment and operating requirements. Usually, the corporation uses these loans to fund its expansion goals, project investments, and day-to-day operations. Bank loans are a vital source of financing for businesses, particularly when substantial financial assistance is needed. This is because they may offer a rather reliable source of finance. SAIC Motor aggressively seeks funding from the financial markets at the same time. In order to finance its growth and development, the corporation issues bonds, stocks, and other financial instruments. One example of how the corporation uses capital markets to finance technical innovation and commercial growth is SAIC Motor Financial Management Co., Ltd., which publicly issued technology innovation bonds to professional investors. After conducting a follow-up analysis and evaluation of SAIC Motor Financial Management Co., Ltd.'s and its related bonds' credit status, United Ratings assigned a credit rating of AAA to both the "23 Shangjin K1" and "23 Shangjin K2" bonds, with a stable rating outlook, and maintained the company's long-term credit rating of AAA.

BAIC Group, as a prominent state-owned firm in China, has forged robust connections with local banks and possesses seamless financing channels in both domestic and international capital markets. The BAIC Group manages its liquidity well by having a surplus of cash and cash equivalents as well as unused bank credit lines. BAIC Group's long-term issuer default rating (IDR) and foreign currency senior unsecured rating have been upgraded to "BBB+." Moreover, BAIC Motor Corporation Limited (HKSE: 01958), a part of the BAIC Group, has maintained its long-term IDR and foreign currency senior unsecured rating at "BBB+," with a stable rating outlook, according to Fitch Ratings. BAIC Group's rating is closely linked to Fitch's internal assessment of the credit status of the Beijing municipal government, reflecting the strong association between the company and the local government. Given the close operational and strategic ties between BAIC Motor and its parent company BAIC Group, Fitch has aligned BAIC Motor's rating with that of BAIC Group using a top-down approach in accordance with its "Parent and Subsidiary Linkage Rating Criteria."

In the critical period of transformation in the automotive industry, GAC Group has adopted a strategy that combines both "aggressive" and "conservative" approaches. This strategy is reflected in its focus on investing in key technologies, where GAC not only emphasizes the application of "three-electric" (battery, electric motor, and electric control) and smart technologies but also actively promotes talent development and innovation in mechanisms. The company has invested heavily in achieving rapid updates and iterations in technology and products, while also using bank loans to support daily operations and project investments, a common financing

method. Additionally, GAC Group actively leverages capital market financing, raising funds through the issuance of bonds and stocks. This not only helps the company gain more financial support but also enhances its market position and overall competitiveness. In 2023, GAC plans to distribute approximately RMB 1.57 billion in dividends with a payout ratio of 36%, continuing its tradition of maintaining an annual payout ratio above 30% since its listing in 2012. Moreover, the company announced for the first time a plan to repurchase A-shares and H-shares, with a total repurchase amount ranging between RMB 500 million and RMB 1 billion, of which the H-share repurchase will range between RMB 400 million and RMB 800 million. In terms of capital allocation, GAC Group has taken a cautious approach. Despite its active market operations, its valuation in the Hong Kong stock market is only 0.27 PB and 7.0 PE, highlighting a significant gap in its market capitalization and valuation compared to its peers. This level of valuation does not fully reflect the company's potential and actual value in the market.

NIO, which has been facing high debt risks, recently secured a strategic investment that has eased its short-term cash flow pressures. At the time of NIO's IPO, 50 million shares were placed in a user trust. Although these shares remain on the equity register, the trust is no longer the largest economic shareholder. However, due to its super-voting rights, the trust still holds the most significant voting power, resulting in minimal changes at the shareholder voting level. As of December 2022, when the investment transaction was completed, CYVN acquired the right to nominate two directors to NIO's board, provided it maintains a beneficial ownership of at least 15% of NIO's outstanding shares. If CYVN's ownership falls below 15% but remains above 5%, it retains the right to nominate one director. Several market experts have noted that, despite the current challenging investment environment, NIO's ability to attract funding from Middle Eastern investors reflects the value of its brand and CEO Li Bin's standing in the capital markets. Following NIO's earnings report, several investment banks, including Deutsche Bank, Citibank, Crédit Lyonnais, and Mizuho Securities, gave NIO a "buy" rating. Deutsche Bank highlighted NIO's strong second-quarter performance, particularly its gross margin, and gave an optimistic outlook for the third quarter. Citibank analysts expect NIO's deliveries to increase monthly from October through December, potentially reaching new highs. Crédit Lyonnais noted that the delivery of the ET5 model could significantly boost NIO's sales and stock price. Given its innovation and market potential, NIO's credit rating in the capital markets could range between BB+ and BBB, indicating a relatively positive market outlook.

According to BYD's 2023 financial report, the company outperformed its former competitors in the domestic market, showcasing strong competitiveness in both sales and financial performance. BYD reached record highs in key metrics such as revenue, profit, R&D investment, and cash flow. The issue of "increasing revenue without increasing profit," which had been a concern in the past, was effectively resolved this year. In 2023, BYD continued to strengthen its leadership in the new energy vehicle (NEV) market and formed a strategic partnership with Uber to introduce 100,000 BYD electric vehicles for global shared mobility services. According to its annual report, BYD remains the most profitable among A-share listed automotive companies, solidifying its position as an industry leader. In a highly competitive market, BYD has become a well-run industry giant with few domestic competitors. Using the Discounted Cash Flow (DCF) model, BYD's intrinsic stock value is estimated at RMB 204 per share. The Price-to-Earnings (P/E) ratio valuation model places the stock price at RMB 137 per share. By averaging these two figures, a more reasonable target price of RMB 170 per share is obtained. Considering the current competitive market environment, a recommended safety margin of 30% suggests a final target price of RMB 119 per share.

Based on the financial statement data, Li Auto's performance can be described as "thriving." The strong support from the Chinese government for new energy vehicles and the subsequent surge in consumer demand for electric vehicles have helped Li Auto establish a foothold in the market, gradually overcoming the challenges of its startup phase. The successful listing of Li Auto on Nasdaq further accelerated the company's business expansion, showcasing a prosperous scene. Haitong International has maintained an "Outperform" rating for Li Auto, with a target price lowered to HKD 149.8. Morgan Stanley has reduced its 2024 sales forecast for Li Auto by 15% due to lower-than-expected demand rebound following the facelift of the L series models and also lowered its 2025 sales forecast by 14%. The firm maintains an "Overweight" rating for Li Auto but has reduced

the target price by 14% to HKD 233. Additionally, Li Auto has become the first Chinese automotive company to receive the highest MSCI ESG rating of "AAA," demonstrating excellent performance. However, Li Auto still needs to improve its social and governance scores to further enhance its overall ESG score.

Tesla's market performance in 2023 can be characterized as "stellar amidst high volatility." Following the release of its financial statements early in the year, capital markets reacted in starkly different ways. U. S. investment firms like Morgan Stanley, Goldman Sachs, and Citigroup gave Tesla a "buy" or "overweight" rating. Morgan Stanley's analyst Adam Jonas and his team were particularly optimistic, setting a target price of $310, suggesting a potential 40% increase in Tesla's stock price. In contrast, international investment banks such as Credit Suisse, BNP Paribas, and Nomura took a more cautious stance, issuing "sell" or "hold" ratings and lowering their target price to around $150. In 2023, Tesla's credit rating was upgraded by Standard & Poor's, reflecting growing confidence in its financial stability and business outlook. S&P highlighted Tesla's significant progress in reducing debt, improving profitability, and expanding its market share, leading to a credit rating upgrade from "B+" to "BB-." This upgrade indicates growing investor confidence in Tesla's continued growth and solidifies its position in the global electric vehicle market.

Volkswagen recently announced a $700 million investment in XPeng Motors, acquiring a 4.99% stake and planning to co-develop two electric vehicle models. Volkswagen will utilize XPeng's "Edward" platform for these new models and will begin paying for technology services next year, breaking from the traditional technology licensing model. Following this news, XPeng's stock surged, with its U.S. shares rising 26.69% and its Hong Kong shares climbing 33.88%, reaching a one-year high, though still below historical peaks. Despite these significant stock gains, Chinese financial institutions have expressed skepticism about the partnership, which was initially expected to disrupt the new energy vehicle sector. Bank of Communications International downgraded XPeng's rating to "Sell," citing an "overreaction" to the stock price and setting a target price of HKD 39.3 / USD 10.5. Currently, XPeng's U. S. and Hong Kong shares are trading at more than double that target price. In contrast, Huatai Securities has maintained a "Buy" rating for XPeng and raised its target price for the company's Hong Kong shares to HKD 92.46. International banks, however, have generally reacted positively to the partnership. UBS has given XPeng a "Buy" rating, stating that the partnership will boost market confidence. Morgan Stanley highlighted the strategic importance of this collaboration between a global automotive giant and a domestic electric vehicle startup, which could pave the way for Chinese automakers to expand overseas. They rated XPeng as "Overweight." Citi also expressed optimism, supporting the positive outlook on the partnership.

5.2. Analysis of Debt Solvency Risks for Traditional and New Energy Vehicles

Perpetual bonds are a type of bond with no fixed maturity date (typically exceeding 30 years) but require periodic interest payments. From this perspective, perpetual bonds are a financing instrument that lies between debt and equity, often referred to as "stocks in the form of bonds." In the event of corporate bankruptcy and liquidation, creditors can only demand repayment of the principal, with their claims ranked lower than common and preferred shareholders, meaning they are positioned further down the repayment hierarchy. Therefore, perpetual bonds typically demand higher returns. Generally, companies choose this type of financing only when the financing environment is extremely challenging and they have no other viable options.

SAIC Motor, BAIC Group, GAC Group, NIO, BYD, Tesla, Li Auto, and XPeng have all used perpetual bonds, but the scale varies among these companies. For traditional automakers (SAIC Motor, BAIC Group, GAC Group), the interest rates paid on perpetual bonds are generally around 4% to 6%. For emerging electric vehicle companies (NIO, Li Auto, XPeng), the interest rates are typically between 6% and 8% or higher. BYD and Tesla fall between these two categories. As a mature new energy company, BYD's rates are approximately 5% to 7%. Tesla, being a leading global electric vehicle company, despite having strong market confidence, faces higher capital demands and rapid business expansion, with interest rates generally around 5% to 7%. SAIC Motor issued RMB 20 billion in perpetual bonds for the first time in August 2023. Therefore, as of 2023, the scale of SAIC Motor's perpetual bonds is RMB 20 billion. BAIC Group issued perpetual bonds for the first time in 2019, amounting to RMB 5 billion. As of 2023, the total scale of BAIC Group's perpetual bonds is

approximately RMB 15 billion. GAC Group issued perpetual bonds for the first time in 2020, with an initial amount of RMB 8 billion. As of 2023, the total scale of GAC Group's perpetual bonds is approximately RMB 12 billion. BYD issued perpetual bonds for the first time in 2022, amounting to RMB 10 billion. As of 2023, the scale of BYD's perpetual bonds is RMB 10 billion. As of 2023, NIO, Li Auto, XPeng, and Tesla have not issued perpetual bonds, so there are no related amounts or scales available. Interest paid to perpetual bondholders by SAIC Motor, BAIC Group, GAC Group, NIO, BYD, Tesla, Li Auto, and XPeng is not included in interest expenses but is recorded as equity. The accounting treatment of perpetual bonds makes them appear as "invisible" debt on financial statements, which might obscure the company's true debt levels and repayment pressures. While this treatment might make the company's financial health look better, investors and creditors still need to pay attention to the actual repayment capacity and cash flow to fully assess the company's financial risk.

According to research reports from Deutsche Bank and other foreign investment banks, incorporating debt into the debt calculations shows a significant increase in SAIC Motor's net debt ratio. Specifically, considering perpetual bonds, SAIC Motor's net debt ratio could reach as high as 65.94%. BAIC Group's net debt ratio is estimated to be 63.69%. GAC Group's debt ratio stands at 43.04%, indicating increased financial leverage risk. NIO's net debt ratio is 80%. BYD's net debt ratio is 77.14%. Li Auto's net debt ratio has been rising annually, climbing from a relatively low level in 2020 to 57.78% in 2023. XPeng's debt ratio is 59%. NIO and BYD have higher net debt ratios, indicating greater financial leverage risk. SAIC Motor and BAIC Group also have high debt ratios, though slightly lower than the former two. GAC Group faces increased financial leverage risk, while Li Auto and XPeng's debt ratios have been rising annually, reflecting growing financial pressure on each company. To mitigate future debt risks, companies issuing perpetual bonds typically redeem a portion of their debt in advance, which also imposes significant financial pressure. Considering the factors involving perpetual bonds, it is noted that SAIC Motor, BAIC Group, GAC Group, Tesla, Li Auto, and XPeng have not issued perpetual bonds, whereas NIO has issued perpetual bonds with a total principal amount of $1 billion, pricing convertible preferred bonds with a principal amount of $500 million due in 2029 and another $500 million due in 2030. This financing is significant for NIO, as it not only enhances its financial strength but also provides funding for future R&D, production, and market expansion. BYD has issued perpetual bonds totaling up to RMB 5 billion. Through these perpetual bonds, BYD can secure a long-term, stable source of funds to support its ongoing technology development and market expansion, further consolidating and enhancing its leading position in the industry. Additionally, when looking at gross profit margins, the profitability levels of SAIC Motor, BAIC Group, GAC Group, NIO, BYD, Tesla, Li Auto, and XPeng over recent years show significant differences, as illustrated in Figure 5.

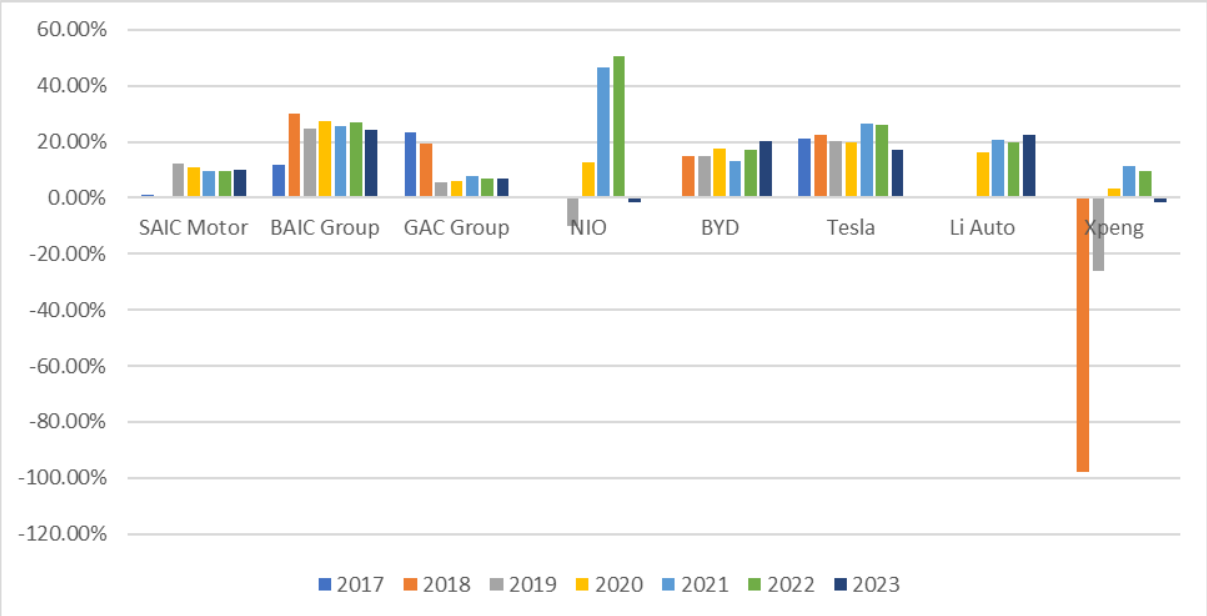

Figure 5. Gross Profit Margin of Traditional and New Energy Vehicles.

From Figure 5, it can be seen that between 2017 and 2023, SAIC Motor's gross profit margin remained relatively stable. Although it peaked at 12.15% in 2019 and then slightly declined, it still stood at 10.19% in 2023. This stable gross profit margin reflects SAIC Motor's maturity in cost control and its solid market position. BAIC's gross profit margin surged to 29.88% in 2018 and remained between 24% and 27% over the next few years. Despite a slight decrease to 24.23% in 2023, the overall gross profit margin remains high, indicating BAIC's cost advantages in production and sales processes. GAC Group's gross profit margin started declining from 23.46% in 2017, falling to 5.55% in 2019. Although it recovered somewhat, it was still relatively low at 6.94% in 2023. This suggests that GAC Group faces certain challenges in market competition and cost control. NIO's gross profit margin exhibits significant volatility. It was zero or negative in 2017 and 2018, and -9.89% in 2019. However, from 2020 onwards, NIO's gross profit margin significantly improved, reaching 46.54% in 2021, but fell back to -1.60% in 2023. This sharp fluctuation indicates cost management issues faced by NIO during rapid expansion. BYD's gross profit margin has been increasing year by year since 2018, reaching 20.21% in 2023. This trend reflects BYD's continued improvement in production efficiency and cost control, with particularly notable performance in the new energy vehicle sector. Tesla's gross profit margin remained relatively stable between 2017 and 2023. Although it decreased to 17.05% in 2023, the overall gross profit margin remains high, showing Tesla's cost control and pricing advantages in the electric vehicle market. Li Auto's gross profit margin has been gradually rising since 2019, reaching 22.73% in 2023, demonstrating Li Auto's growing maturity in the market and significant improvement in profitability. In contrast, XPeng's gross profit margin has been very unstable, with negative values in 2018 and 2019, and falling back to -1.60% in 2023. This indicates that XPeng needs to further enhance its cost structure and market competitiveness. Combining these analyses, companies with high gross profit margins, such as BYD, Tesla, and Li Auto, generally exhibit strong profitability and stable cash flows. This enables them to secure financing at lower interest rates due to their solid financial positions and lower debt risks. On the other hand, companies with lower or more volatile gross profit margins, such as GAC Group, NIO, and XPeng, may face higher financing costs. Poor or fluctuating gross profit margins increase financial uncertainty, leading creditors to demand higher interest rates to mitigate risks or imposing stricter financing conditions on these companies.

6. Insights and Recommendations

The above study indicates that different automotive businesses demonstrate varying performances about their capacity to repay long-term debt and their level of financial leverage. BAIC Group ‘s debt has increased, GAC Group is dependent on debt financing, NIO is trying to lower its debt, BYD is having financial difficulties, Tesla's debt management strategy is erratic, Li Auto's financial situation is gradually getting better, and XPeng employs a cautious debt management strategy. In contrast, Shanghai Automotive is steadily improving. While BYD and BAIC Group score rather poorly, Tesla, Li Auto, and XPeng demonstrate great performance in terms of short-term loan repayment capabilities. The following cautions for the automobile sector on “inventory reduction” and “de-leveraging” are revealed by the debt risk analysis for SAIC Motor, BAIC Group, GAC Group, NIO, BYD, Tesla, Li Auto, and XPeng:

(1) High-leverage firms, such as GAC Group, are vulnerable to severe payback pressure in the event of a change in market conditions, such as a downturn in sales or increased financing costs. These organizations have achieved quick expansion with extensive borrowing. High-leverage businesses must exercise caution to prevent taking on excessive financial risk as a result of blind expansion, particularly in light of the growing unpredictability of the global economy. Businesses should improve their debt management strategies, limit leverage levels in a reasonable manner, and make sure that financial leverage is steady despite changes in the economy.

(2) Inventory Control: An essential function in the capital-intensive automotive sector is inventory control. Having too much inventory may lock up a lot of capital, which can cause problems with cash flow and put more strain on financial debt. To reduce financial risk, businesses like Beijing Automotive and BYD must quickly modify inventories in reaction to poor market demand or supply chain interruptions. Achieving better financial circumstances, lowering capital occupancy, and relying less on outside funding are all made possible by efficient

inventory management.

(3) Debt Structure Optimization: NIO and Li Auto serve as examples of how crucial it is to optimize debt structure by gradually reducing debt. Improving a company's debt structure reduces expenses while strengthening its defense against risk. Prioritizing retained profits and equity financing can help businesses boost capital while lowering their reliance on expensive debt and lowering their risk of financial strain. Furthermore, looking into ways to prolong debt maturities, including issuing convertible or long-term bonds, might lessen the need to make repayments quickly.

(4) Adaptable Debt Management: Tesla's approach to debt management highlights the necessity of adaptability in terms of debt and inventory adjustments in response to market swings. Because high-leverage organizations are more vulnerable to shifts in the economy or industry cycles, having flexible finances is essential. To reduce the impact of market swings, businesses should modify their capital structure and debt levels in accordance with the state of the economy and market demand. During periods of elevated market demand volatility, enhancing cash flow management and augmenting liquidity are vital for promptly addressing external obstacles.

(5) Short-Term Debt Repayment Capacity: This is a vital sign of a business's capacity to manage debt. Businesses like XPeng that have higher liquidity ratios demonstrate a greater capacity to repay debt in the near term and are better equipped to handle debt pressure. Conversely, businesses with lower fast ratios, like Beijing Automotive and BYD, exhibit susceptibility when it comes to short-term debt repayment and may run into financial issues when faced with restricted cash flow. To handle the strain of short-term debt, businesses must thus retain enough liquidity during the deleveraging process. Financial crises brought on by a lack of liquidity can be averted by strengthening short-term repayment capacity and improving cash management.

(6) Synchronized Intermediate- and Long-Term Plans: Companies should coordinate both short- and long-term objectives during the "inventory reduction" and "de-leveraging" operations to maintain sustainable development and financial health. Long-term capital structure optimization and a decrease in reliance on expensive debt are essential, but short-term liquidity needs must be met to manage unforeseen market fluctuations. During the "inventory reduction" and "de-leveraging" processes, businesses can achieve financial stability and sustainable growth by striking a balance between long-term steady development and short-term flexibility.

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References

1 Ma H. Debt Risk Analysis of Real Estate Enterprises—A Case Study of "Hengda Real Estate". *Journal of Shaan xi Xueqian Normal University* 2016; (**08**): 22–26.

2 Liu X, Liu H. The Application of ANN-FLUS Model In Reconstructing Historical Cropland Distribution Changes: A Case Study of Vietnam from 1885 to 2000. *Journal of Natural Resources* 2024; **39**(**6**): 1473–1492

3 Liang J, Liu W. The Impact of Innovation Capability on Financial Performance in the New Energy Vehicle Industry-An Empirical Study of Listed Companies in China. *Review of Industrial Economics* 2023; (**06**): 5–26.

4 Song Y. Discussion on the Feasibility Analysis of Financial Data of the Automotive Industry under the Dimension of OTA Technology and Policy to Help Vehicle Consumption—Taking Tesla as an Example. *Auto Time* 2023; (**22**): 183–185+198.

5 Feng L. Parameter Optimization of End Face Robot Die Forging Based on GA Optimization ANN Method. *Forging Equipment and Manufacturing Technology* 2024; **59**(**03**): 99–101.

6 Pauwels K, Silva-Risso J, Srinivasan S, et al. New Products, Sales Promotions, and Firm Value: The Case of the Automobile Industry. *Journal of Marketing* 2004; **68**(**4**): 142–156.

7 Kumar G, Maqbool J. Financial Technology in the Automobile Industry. *Proceedings of the Applied Management Conference* 2018; **1**(**2**).

8 Dai L. Study on Financial Competitiveness of Listed Companies in New Energy Vehicle Industry—BYD as an Example. *Advances in Economics*, *Management and Political Sciences* 2023; **30**: 94–102.

9 Xu X. Construction of Financial Early Warning Model forListed Enterprises Based on SVM and ANN. *Techniques of Automation and Applications* 2021; **40**(**05**):171–174.

10 Huang H, Jiang W, Wang S. Research of Financial Early-Warning for Listed Companies Based on SVM. In Proceedings of the 2015 International Conference on Computational Science and Engineering, Qingdao, China, 20–21 July 2015; pp. 278–281.

11 Yan X, Zhou Q. Research on Financial Development Capability of Listed Companies Based on Multiple Regression Model—Take BYD as an Example. *Academic Journal of Business & Management* 2022; **4**(**11**).

12 He Y, Rachev S. Exploring Implied Certainty Equivalent Rates in Financial Markets: Empirical Analysis and Application to the Electric Vehicle Industry. *Journal of Risk and Financial Management* 2023; **16**(**7**): 344.

13 Qian J. Research on Financial Risk Assessment of Xiaopeng Motors. *E-Commerce Letters* 2024; **13**: 5024.

14 Tao W. Research on Financial Risk Issues in the New Energy Vehicle Industry: Taking C Automobile Company as an Example. *Modern Management* 2024; **14**: 2089.